

Amendments to the Specification

The paragraph starting at page 2, line 6 and ending at line 17 has been amended as follows.

As a method for manufacturing an ink jet recording head, a method is described in Japanese Patent Application Laid-Open No. H06-286149, according to which an ink flow path pattern is formed by using a dissolvable resin, and is coated by an epoxy resin, and, ~~according to which~~, thereafter, discharge ports are formed and the dissolvable resin is removed. Further, another method is disclosed in Japanese Patent Laid-Open Application No. 2001-179990, according to which a substance that inhibits photo curing of a discharge port formation material is mixed with a removable resin.

The paragraph starting at page 5, line 6 and ending at line 14 has been amended as follows.

As a result, for a shape wherein the flow path height is extended and the PH (OP thickness) is thin, the difference in the amount of irradiated light is increased even more. Through an analysis of the ~~cross-section~~ cross-section of the minute discharge port, it was found that the scum can be clearly observed at the interface between the removable resin and the discharge port formation material used for forming ink discharge ports.

The paragraph starting at page 6, line 11 and ending at page 7, line 8 has been amended as follows.

To achieve this objective, according to the invention, a method for manufacturing a liquid discharge head comprises the steps of:

forming a solid layer, for forming a flow path, on a substrate on which an energy generating element is arranged to generate energy that is used to discharge liquid;

forming, on the substrate whereon the solid layer is mounted, a coating layer for coating the solid layer;

forming a discharge port used to discharge a liquid, through a photolithography process, in the coating layer deposited on the solid layer; and

removing the solid layer to form a flow path that ~~communicate~~ communicates with the energy element and the discharge port,

whereby a material used for the coating layer contains a cationically polymerizable chemical compound, a cationic photopolymerization initiator and a an inhibitor of cationic photopolymerization, and

whereby a material used for the solid layer that forms a boundary, with a portion wherein the discharge port of the coating layer are formed, contains a copolymer of methacrylic anhydride and methacrylate ester.

The paragraph starting at page 7, line 9 and ending at line 15 has been amended as follows.

A liquid discharge head according to this invention is manufactured using the above described manufacturing method, and a discharge port formation material for forming a discharge port for this head contains a cationically polymerizable chemical compound, a cationic photopolymerization initiator and ~~a~~ an inhibitor of cationic photopolymerization.

The paragraph starting at page 7, line 18 and ending at line 21 has been amended as follows.

FIGS. 1A, 1B, 1C, 1D and 1E are diagrams showing the ~~processing~~ process for forming ink flow paths according to a first embodiment of the present invention;

The paragraph starting at page 8, line 19 and ending at line 22 has been amended as follows.

FIGS. 9A, 9B, 9C, 9D, 9E, 9F, 9G, 9H and 9I are diagrams showing the ~~processing~~ process for forming ink flow paths according to a fourth embodiment of the present invention;

The paragraph starting at page 14, line 13 and ending at page 15, line 17 has been amended as follows.

A photocurable composite that contains a cationically polymerizable chemical compound, a cationic photopolymerization initiator and ~~a~~ an inhibitor of cationic photopolymerization is employed as a curable composite of a negative photosensitive type as a discharge port formation material. The cationically polymerizable chemical compound contained in the photocurable composite is used to combine compounds by using a cationic addition polymerization reaction. For example, an epoxy compound in the solid state at normal temperature, described in Japanese Patent No. 3,143,307, can be appropriately employed. This epoxy compound can, for example, be a reactant of bisphenol A and epichlorohydrin, the molecular weight of which is, at ~~the~~ least, about 900, a reactant of bromine-containing phenol A and epichlorohydrin, a reactant of phenolnovolac or ortho-cresolnovolac and epichlorohydrin, or a multi-reactive epoxy resin having an oxycyclohexane framework described in Japanese Patent Laid-Open Application Nos. S60-161973, S63-221121, S64-9216 and H02-140219, and one or more of two types of these epoxy compounds can be employed. Further, for these epoxy compounds, preferably, the equivalent epoxy weight is equal to or smaller than 2000, or more preferably, is equal to or smaller than 1000. This is because, when the equivalent epoxy weight exceeds 2000, the bridge density is reduced as a result of the curing reaction, and either T_g, or the heat deflection temperature of the cured product, will be reduced, or the adhesiveness and the ink resistance will be deteriorated.

The paragraph starting at page 17, line 2 and ending at page 18, line 8 has been amended as follows.

The inhibitor of cationic photopolymerization is also added to the photocurable composite. The inhibitor of cationic photopolymerization adjusts the curing of a photocurable composite to inhibit the formation of a cured layer by light that reaches the unexposed portion that is used as a discharge port, at the interface between the positive type resist layer (solid layer) and the negative type resist layer (nozzle formation material layer) that was previously described. An arbitrary inhibitor of cationic photopolymerization can be employed so long as a desired curing characteristic at the light irradiation portion and scum occurrence prevention effects are obtained, and so long as the function of an acid catalyst can be degraded.

Generally, a basic material is employed as a an inhibitor of cationic photopolymerization, and a compound that can be used as an acceptor for protons, i.e., a basic material having a pair of nonshared electrons is appropriate. A nitrogen-containing compound having a pair of nonshared electrons is a compound that acts as a base relative to acid and that can effectively prevent the occurrence of scum. A specific nitrogen-containing compound is a compound containing nitrogen atoms, sulfur atoms or phosphorus atoms, and a typical example is an amine compound. Specifically, such amine compounds are: an amine, such as diethanolamine, triethanolamine or triisopropanolamine, replaced by a hydroxyalkyl having a carbon number of one or greater to four or smaller; a pyrimidine compound, such as pyrimidine, 2-aminopyrimidine or 4-aminopyrimidine; a pyridine compound, such as pyridine or methyl pyridine; and aminophenol, such as 2-aminophenol or 3-aminophenol.

The paragraph starting at page 23, line 22 and ending at page 24, line 1 has been amended as follows.

FIGS. 4A to 4F are cross-sectional views for explaining ~~example~~ solid layer formation processing that can be employed for the present invention. A second embodiment of this invention differs from the first embodiment in that a laminated structure, for which a plurality of materials are used, is employed for the solid layer.

The paragraph starting at page 25, line 10 and ending at line 18 has been amended as follows.

The exposed positive type resist layer 13 is developed using an alkaline liquid mixture of diethylene glycol, morpholine, monoethanolamine and pure water, and a predetermined pattern is obtained. With this alkaline development liquid, the speed of dissolution of the acrylic resist of the non-exposed portion can be greatly reduced, and the ~~affect~~ effect on the lower layer, during the development of the upper layer, is less significant.

The paragraph starting at page 27, line 22 and ending at page 28, line 16 has been amended as follows.

Then, as shown in FIG. 5C, a positive type resist layer (P(MMA-MAN) layer) 13 of 6 μm thick is formed on the ODUR layer 12 using spin coating. Following this, the P(MMA-MAN) layer 13 is exposed to obtain a structure shown in FIG. 5D. As previously described, a photomask with which the exposed portions are to be removed is employed for the P(MMA-MAN) layer 13. At this time, when the wavelength area of 230 to 260 nm is designated as the exposure wavelength area, the lower positive type resist layer 12 is almost not exposed. This is because the absorption of ketone is due to a carbonyl group, and light of 230 to 260 nm is almost all transmitted through. The exposed P(MMA-MAN) layer 13 is developed by an alkaline liquid mixture of diethylene glycol, morpholine, monoethanolamine and pure water, and a predetermined pattern is obtained. With this development liquid, the dissolving speed of the acrylic resist of the non-exposed portion can be lowered greatly, and the ~~affect~~ effect on the lower layer during the development of the upper layer can be less significant.